

PATENT SPECIFICATION

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(54) AGRICULTURAL MULCH

(71) We, PRINCETON CHEMICAL RE-
 SEARCH INCORPORATED, a Corporation orga-
 nised and existing under the laws of the State
 of New Jersey, United States of America, of
 5 P.O. Box 652, Princeton, New Jersey, 08540,
 U.S.A., do hereby declare the invention for
 which we pray that a Patent may be granted
 to us and the method by which it is to be
 performed to be particularly described in and
 10 by the following statement:—

This invention is concerned with improve-
 ments in or relating an agricultural mulch
 and is especially concerned with agricultural
 mulches comprising organic polymeric
 15 material.

Agricultural mulches are in general well
 known, and are used to cover the soil around
 crops or other plants in order to prevent or
 retard weed growth and to increase soil water
 20 retention and temperature. Thus, it is possible
 to plant earlier and prevent frost damage.
 Various naturally occurring materials have
 been used for this purpose for many years
 and amongst these materials are peat, peat
 25 moss, wood chips, chopped bark and sawdust.

In recent years, it has been discovered that
 some synthetic polymeric materials, e.g., poly-
 ethylene, have utility as mulches. Polyethylene
 film has been used for this purpose both in
 30 its translucent or transparent state, or in its
 opaque state, i.e., filled with an opaque filler
 such as carbon black. Polyethylene was ori-
 ginally considered admirably suited to this use
 because it withstood weathering very well and
 35 thus could be re-used year after year. In this
 respect, the polyethylene mulch could be and
 was picked up off the ground at the end of
 a growing season and re-layed after plough-
 ing at the beginning of the next growing
 40 season. By thus re-using the mulch for more
 than one growing season, it was thought that
 economic advantage was thus given to the
 farmer sufficient to induce him to purchase
 the polyethylene mulch, which probably car-
 45 ries a somewhat higher price than the various
 natural mulches.

It has been found, however, that at least
 under certain circumstances and with certain

crops, it is not economically desirable to pick
 up the mulch at the end of a growing season
 and re-lay it the next year. Rather it would
 be more desirable not to have to pick up the
 mulch, thus more closely conforming to the
 practice with natural mulches. These natural
 55 mulches are not picked up but rather are
 turned back into the soil upon ploughing at
 the start of the next growing season.

Further, it has been discovered that certain
 desirable materials can be incorporated into
 a mulch of polymeric material which are then
 leached out during the growing season at
 60 some rate depending upon weather and parti-
 cularly rainfall conditions. These materials in-
 clude herbicides, insecticides, fertilizers, and
 soil conditioners, such as alkaline agents. It is
 possible that under certain weather condi-
 tions not all of these materials will be leached
 out of the polymeric mulch during the grow-
 ing season, and that therefore that which re-
 70 mains in the mulch is lost to the soil until
 the next growing season, when the mulch is re-
 layed. However, some of these materials which
 remain in the mulch will be lost during winter
 storage. Further, if all of these materials are
 75 used either in one growing season or over
 other periods of time, when the mulch is re-
 applied, these same materials will have to be
 re-added to the soil through means other than
 the mulch since reincorporation of them into
 80 the mulch would be extremely inconvenient
 and expensive.

It is therefore an object of this invention to
 provide improved agricultural mulch which
 need not be taken up and re-used after a
 growing season. 85

The present invention provides an agricul-
 tural mulch decomposable when subjected to
 weathering during a growing season and con-
 sisting essentially of a continuous film of
 at least 1 mil thickness of polybutene-1 hav-
 90 ing a molecular weight in the range of 10,000
 to 2,000,000, which continuous film of poly-
 butene-1 is normally decomposable without
 the incorporation of any additives therein in
 a period which is substantially less than one
 95 growing season, and containing a sufficient

quantity of anti-oxidant material and ultraviolet light absorber to extend the normal decomposition period of said film to a period which is substantially longer than the normal decomposition period thereof and can be as long as one growing season.

The molecular weights referred to herein are determined by ASTM D-1238-65J — 190°C — 2160 grams.

Butene-1 polymers have the very desirable characteristic of being decomposable when subjected to weathering over a period of time which is normally less than the extent of a growing season. Further, they have the capability of decomposing over a period of time when contacted with soil, so that it is possible and practical to leave mulches comprising polybutene-1 on the ground at the end of the growing season and merely plow under any mulch which remains at the start of the next growing season. These mulches may have incorporated therein one or more of the many materials conventionally incorporated in mulches, in the amounts and for the purposes conventionally employed. Thus, for example, there may be incorporated therein fertilisers, herbicides, insecticides, soil conditioners and/or opacifying agents. These materials may comprise up to 75 weight percent of the total mulch. Exemplary of these various additive materials are carbon black, urea, calcium phosphate, magnesium phosphate, potassium phosphate, potassium nitrate, ammonium nitrate and potassium chloride. It has been found desirable to provide up to about 40 weight percent fertilizer in the mulch.

Particular advantage has been realized through the use of a mulch according to this invention with such high value crops as strawberries, pineapples and tomatoes. The crops in question are preferably planted through the film at selected intervals. It has been found that sunlight particularly induces the decomposition of polybutene-1 and so the mulch will substantially decompose over a period of time less than a growing season; whatever mulch remains can be ploughed back into the ground where decomposition of the exposed portions will continue. In this manner none of the material added to the polybutene-1 is lost and all of its finds its way into the soil. Further the mulch need not be picked up at the end of the season, thereby eliminating a troublesome, expensive and time-consuming operation. By varying the amount and nature of the known ultraviolet stabilizer employed, it is practical to gauge the decomposition rate and thus the total decomposition time for any given mulch.

The polybutene-1 may be mixed with butene-1 copolymers and/or homo-or copolymers of other monomers. Ethylene-propylene rubber and cis-poly-butadiene have been found to be particularly effective.

More preferably the molecular weight of

the polybutene-1 is within the range 40,000 to 1,500,000.

Understanding of this invention will be facilitated by reference to the following Examples which are illustrative of this invention but not limiting thereon:

In each Example, the term "parts" means "parts by weight".

EXAMPLE 1

A decomposable agricultural mulch according to the invention comprises a polybutene-1 resin (100 parts) of 1×10^6 molecular weight which is admixed on a rubber mill with potassium chloride (7 parts) calcium phosphate (7 parts) and urea (23 parts). The mulch mixture is milled at 260°F. and is sheeted out to give a film 1.5 mils thickness.

EXAMPLE 2

Another decomposable agricultural mulch according to the invention comprises polybutene-1 (100 Parts) which is ground in a Banbury mixer at 300°F. with a mixture of urea (20 parts), ammonium nitrate (20 parts), calcium phosphate (12 parts) and potassium chloride (10 parts). The mulch mixture is sheeted out in the form of a film 0.1 mil in thickness.

EXAMPLE 3

The film materials obtained from Examples 1 and 2, when applied over moist earth, with seedlings planted therethrough, gave the same favorable moisture and weed control results as polyethylene, but in addition underwent degradation with concomitant leaching of the fertilizer materials into the soil, with pulverization of the film taking place near the end of the growing season.

WHAT WE CLAIM IS:—

1. An agricultural mulch decomposable when subjected to weathering during a growing season and consisting essentially of a continuous film of at least 1 mil thickness of polybutene-1 having a molecular weight in the range of 10,000 to 2,000,000, which continuous film of polybutene-1 is normally decomposable without the incorporation of any additives therein in a period which is substantially less than one growing season, and containing a sufficient quantity of anti-oxidant material and an ultraviolet light absorber to extend the normal decomposition period of said film to a period which is substantially longer than the normal decomposition period thereof and can be as long as one growing season.

2. An agricultural mulch according to Claim 1 and containing up to 75 weight percent of an agricultural additive in admixture therewith.

3. An agricultural mulch according to either one of Claims 1 and 2 wherein the agricul-

tural additive comprises a herbicide, an insecticide, a soil conditioning agent and/or a fertiliser.

5 4. An agricultural mulch according to Claim 3 wherein the agricultural additive comprises calcium phosphate and urea.

10 5. An agricultural mulch according to any one of the preceding Claims wherein the polybutene-1 has a molecular weight within the range 40,000 to 1,500,000.

6. An agricultural mulch according to Claim 1 substantially as hereinbefore described with reference to Example 1.

7. An agricultural mulch according to Claim 1 substantially as hereinbefore described with reference to Example 2. 15

8. An agricultural mulch according to Claim 1 substantially as hereinbefore described with reference to Example 3.

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